

## CLAIMS

1. A plasma processing apparatus for effecting predetermined processing on a substrate by exposing the substrate to a plasma production region, comprising:

5 a chamber (1) in which the substrate (15) is introduced;

a top plate portion (5) arranged above said substrate (15) introduced in said chamber (1), and forming a part of a wall of said chamber (1); and

10 an antenna portion (7) supplying a high-frequency electromagnetic field into said chamber (1) to form the plasma production region (17) in a region between said top plate portion (5) and said substrate (15) located in said chamber (1), wherein

15 said antenna portion (7) includes a radial waveguide (17a) having a predetermined inner diameter,

15 said chamber (1) has a predetermined inner diameter in a portion containing said top plate portion (5) and said antenna portion (7), and

20 assuming that said radial waveguide (17a) has the inner diameter of A, the portion containing said top plate portion (5) and said antenna portion (7) has the inner diameter of B, and the high-frequency electromagnetic field has a wave length of  $\lambda_g$ , based on a composite dielectric constant resulting from a dielectric constant of said top plate portion (5) and a dielectric constant of a space of the portion containing said top plate portion (5) and said antenna portion (7), the following formula is satisfied:

$$(B - A)/2 = (\lambda_g/2) \cdot N$$

where N is zero or a natural number.

2. The plasma processing apparatus according to claim 1, wherein

25 a portion of said chamber (1) opposed to a region for forming said plasma has a predetermined inner diameter, and

assuming that said region for forming the plasma has the inner diameter of C, the following formula is satisfied:

$C \leq A$

3. The plasma processing apparatus according to claim 2, wherein  
said top plate portion (5) includes a dielectric material.

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4. The plasma processing apparatus according to claim 1, wherein  
said top plate portion (5) includes a dielectric material.